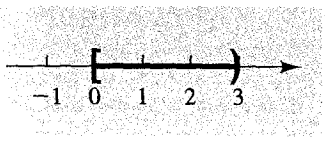
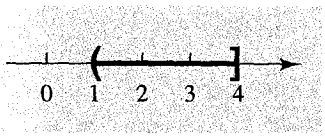
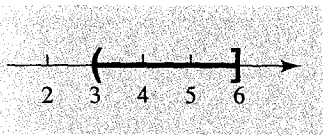
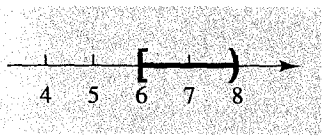
Exercises 3.3 Set I

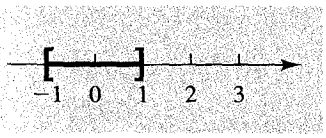
In Exercises 1–8, write, in set-builder notation and in interval notation, the algebraic statement that describes the set that is graphed.

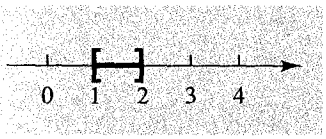
1. 

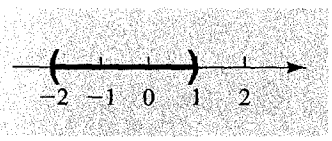
2. 

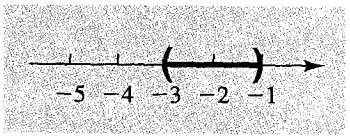
3. 

4. 

5. 

6. 

7. 

8. 

In Exercises 9–22, solve each inequality, writing the solution in interval notation *whenever possible*, and graph the solution set, unless it is { }.

9. $5 > x - 2 \geq 3$
10. $7 > x - 3 \geq 4$
11. $-5 \geq x - 3 \geq 2$
12. $-3 \geq x - 2 \geq 4$
13. $-4 < 3x - 1 \leq 7$
14. $-6 < 4x - 2 \leq 5$
15. $x - 1 > 3$ or $x - 1 < -3$
16. $x - 2 > 5$ or $x - 2 < -5$
17. $2x + 1 \geq 3$ or $2x + 1 \leq -3$
18. $3x - 2 \geq 5$ or $3x - 2 \leq -5$
19. $x > 4$ and $x \geq 2$
20. $x < 3$ and $x < -1$
21. $x > 4$ or $x \geq 2$
22. $x < 3$ or $x < -1$

In Exercises 23–28, rewrite each inequality in roster notation and graph it.

23. $\{x \mid -5 \leq x - 3 \leq 2, x \in N\}$
24. $\{x \mid -3 \leq x - 2 \leq 4, x \in N\}$
25. $\{x \mid 4 \geq x - 3 > -5, x \in J\}$
26. $\{x \mid 6 \geq x - 2 > -4, x \in J\}$
27. $\{x \mid -3 \leq 2x + 1 \leq 7, x \in N\}$
28. $\{x \mid -5 \leq 2x + 3 \leq 5, x \in N\}$

Exercises 3.3 (page 121)

1. $\{x \mid 0 \le x < 3\}$; $[0, 3)$ **2.** $\{x \mid 1 < x \le 4\}$; $(1, 4]$

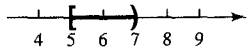
3. $\{x \mid 3 < x \le 6\}$; $(3, 6]$ **4.** $\{x \mid 6 \le x < 8)\}$; $[6, 8)$

5. $\{x \mid -1 \le x \le 1\}$; $[-1, 1]$ **6.** $\{x \mid 1 \le x \le 2\}$; $[1, 2]$

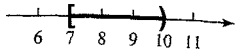
7. $\{x \mid -2 < x < 1\}$; $(-2, 1)$ **8.** $\{x \mid -3 < x < -1\}$; $(-3, -1)$

9.
$$\begin{aligned} 5 > x - 2 &\ge 3 \\ 5 + 2 > x - 2 + 2 &\ge 3 + 2 \\ 7 > x &\ge 5 \end{aligned}$$
or $5 \le x < 7$

$[5, 7)$;



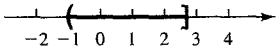
10. $[7, 10)$;



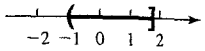
11. "$-5 \ge 2$" is false; therefore, the solution set is $\{\ \}$; there is no graph.

12. The solution set is $\{\ \}$; there is no graph.

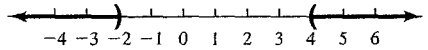
13.
$$\begin{aligned} -4 < 3x - 1 &\le 7 \\ -4 + 1 < 3x - 1 + 1 &\le 7 + 1 \\ -3 < 3x &\le 8 \\ \frac{-3}{3} < \frac{3x}{3} &\le \frac{8}{3} \\ -1 < x &\le \frac{8}{3} \end{aligned}$$
$\left(-1, \frac{8}{3}\right]$;



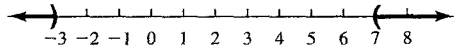
14. $\left(-1, \frac{7}{4}\right]$;



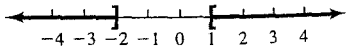
15.
$$\begin{aligned} x - 1 > 3 \quad &\text{or} \quad x - 1 < -3 \\ x - 1 + 1 > 3 + 1 \quad &\text{or} \quad x - 1 + 1 < -3 + 1 \\ x > 4 \quad &\text{or} \quad x < -2 \end{aligned}$$
$(-\infty, -2) \cup (4, +\infty)$;



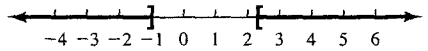
16. $(-\infty, -3) \cup (7, +\infty)$;



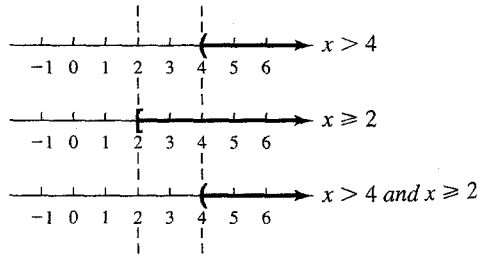
17.
$$\begin{aligned} 2x + 1 \ge 3 \quad &\text{or} \quad 2x + 1 \le -3 \\ 2x + 1 - 1 \ge 3 - 1 \quad &\text{or} \quad 2x + 1 - 1 \le -3 - 1 \\ 2x \ge 2 \quad &\text{or} \quad 2x \le -4 \\ x \ge 1 \quad &\text{or} \quad x \le -2 \end{aligned}$$
$(-\infty, -2] \cup [1, +\infty)$;



18. $(-\infty, -1] \cup \left[\frac{7}{3}, +\infty\right)$;

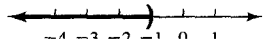


19.

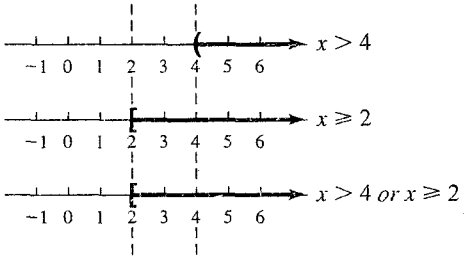


Final inequality: $x > 4$; $(4, +\infty)$

20. $(-\infty, -1)$;

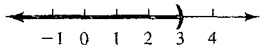


21. $x > 4$ or $x \ge 2$;

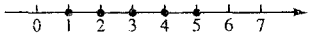


Final inequality: $x \ge 2$; $[2, +\infty)$

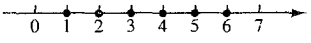
22. $(-\infty, 3)$;



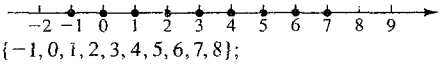
23.
$$\begin{aligned} -5 \le x - 3 &\le 2 \\ -5 + 3 \le x - 3 + 3 &\le 2 + 3 \\ -2 \le x &\le 5 \end{aligned}$$
but $x \in N$; the solution set is $\{1, 2, 3, 4, 5\}$.



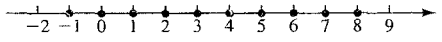
24. $\{1, 2, 3, 4, 5, 6\}$;



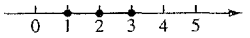
25.
$$\begin{aligned} 4 \ge x - 3 &> -5 \\ 4 + 3 \ge x - 3 + 3 &> -5 + 3 \\ 7 \ge x &> -2 \end{aligned}$$
but $x \in J$; the solution set is $\{-1, 0, 1, 2, 3, 4, 5, 6, 7\}$.



26. $\{-1, 0, 1, 2, 3, 4, 5, 6, 7, 8\}$;



27.
$$\begin{aligned} -3 \le 2x + 1 &\le 7 \\ -3 - 1 \le 2x + 1 - 1 &\le 7 - 1 \\ -4 \le 2x &\le 6 \\ -2 \le x &\le 3 \end{aligned}$$
but $x \in N$; the solution set is $\{1, 2, 3\}$.



28. $\{1\}$;